OIPE
OCT 27 2004
PATENT & TRADEMARK OFFICE

FIG. 1

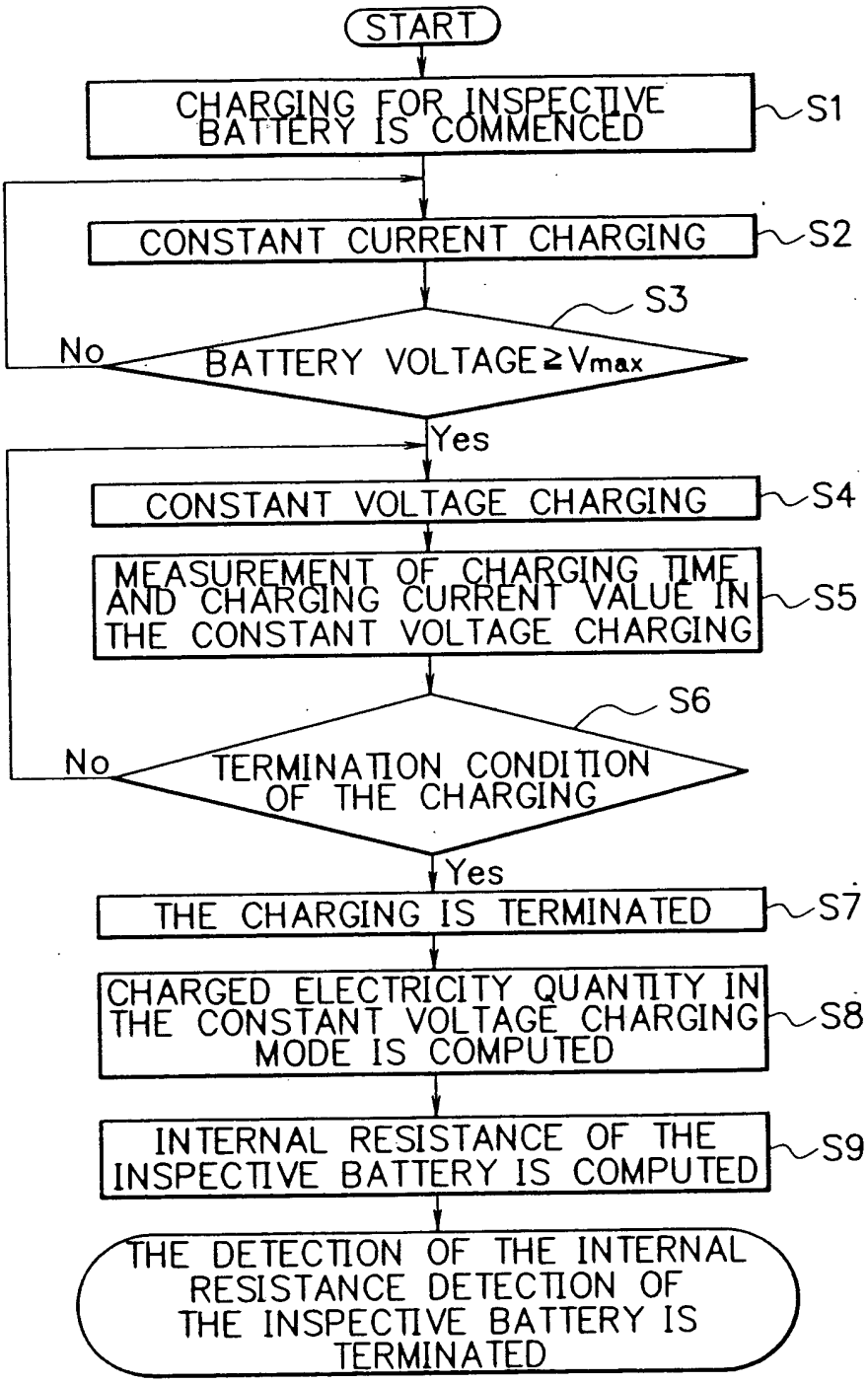


FIG. 2

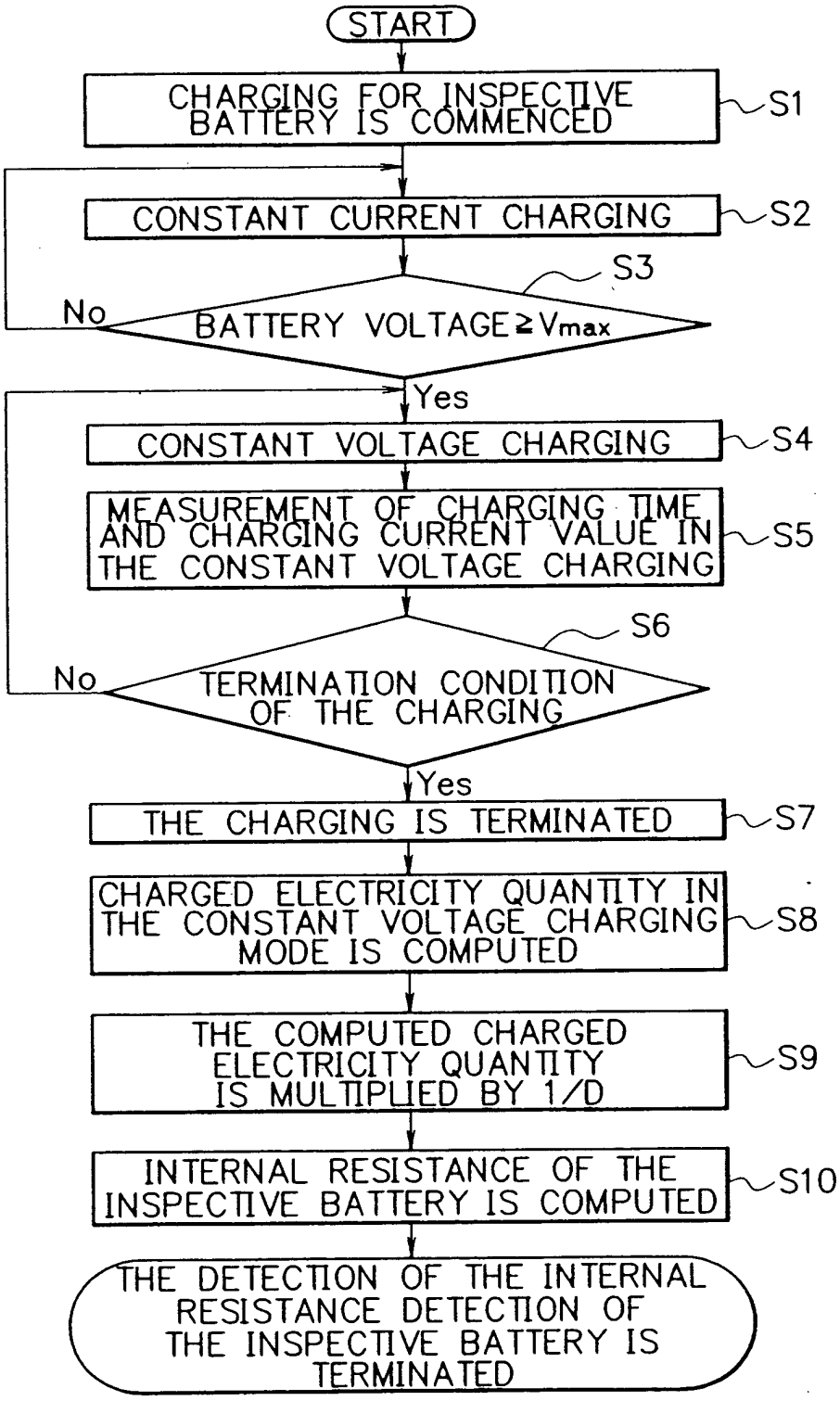

START
CHARGING FOR INSPECTIVE BATTERY IS COMMENCED
S1
CONSTANT CURRENT CHARGING
S2
S3
No
BATTERY VOLTAGE ≥ Vmax
Yes
CONSTANT VOLTAGE CHARGING
S4
MEASUREMENT OF CHARGING TIME AND CHARGING CURRENT VALUE IN THE CONSTANT VOLTAGE CHARGING
S5
S6
No
TERMINATION CONDITION OF THE CHARGING
Yes
THE CHARGING IS TERMINATED
S7
CHARGED ELECTRICITY QUANTITY IN THE CONSTANT VOLTAGE CHARGING MODE IS COMPUTED
S8
THE COMPUTED CHARGED ELECTRICITY QUANTITY IS MULTIPLIED BY 1/D
S9
INTERNAL RESISTANCE OF THE INSPECTIVE BATTERY IS COMPUTED
S10
THE DETECTION OF THE INTERNAL RESISTANCE DETECTION OF THE INSPECTIVE BATTERY IS TERMINATED

FIG. 3

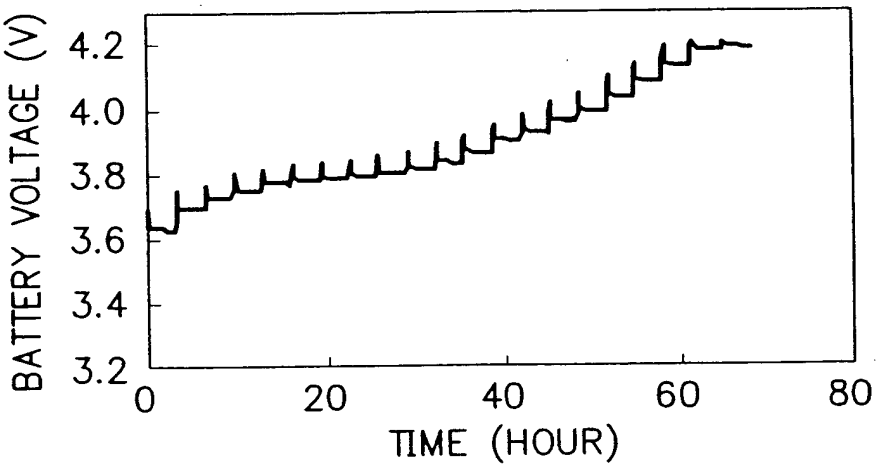

BATTERY VOLTAGE (V)
4.2
4.0
3.8
3.6
3.4
3.2
0
20
40
60
80
TIME (HOUR)

FIG. 4

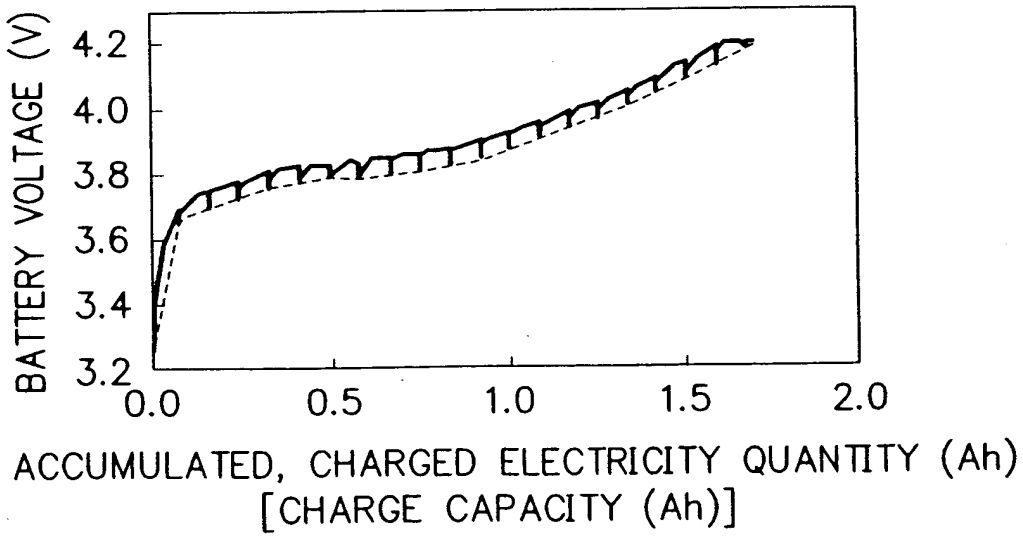

BATTERY VOLTAGE (V)
4.2
4.0
3.8
3.6
3.4
3.2
0.0
0.5
1.0
1.5
2.0
ACCUMULATED, CHARGED ELECTRICITY QUANTITY (Ah)
[CHARGE CAPACITY (Ah)]

FIG. 5

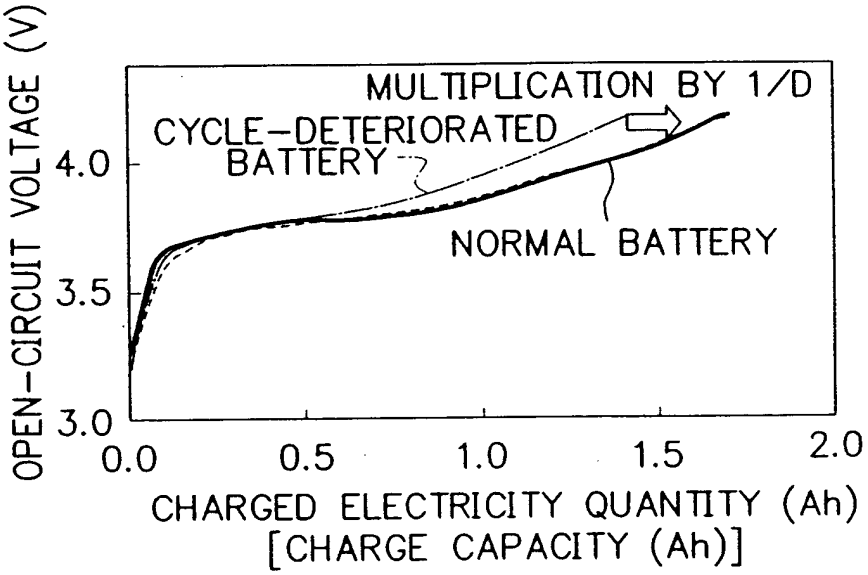

OPEN-CIRCUIT VOLTAGE (V)
4.0
3.5
3.0
0.0
0.5
1.0
1.5
2.0
MULTIPLICATION BY 1/D
CYCLE-DETERIORATED BATTERY
NORMAL BATTERY
CHARGED ELECTRICITY QUANTITY (Ah)
[CHARGE CAPACITY (Ah)]

FIG. 6

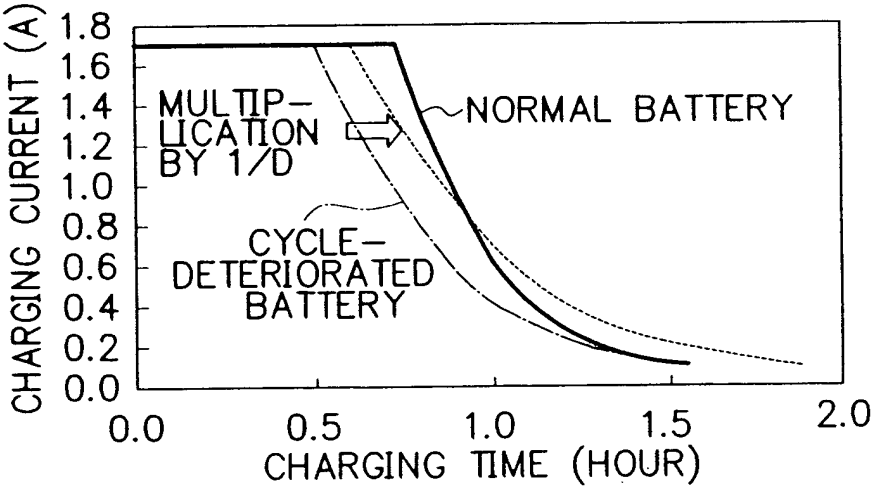

CHARGING CURRENT (A)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.5
1.0
1.5
2.0
MULTIP-LICATION BY 1/D
NORMAL BATTERY
CYCLE-DETERIORATED BATTERY
CHARGING TIME (HOUR)

FIG. 7

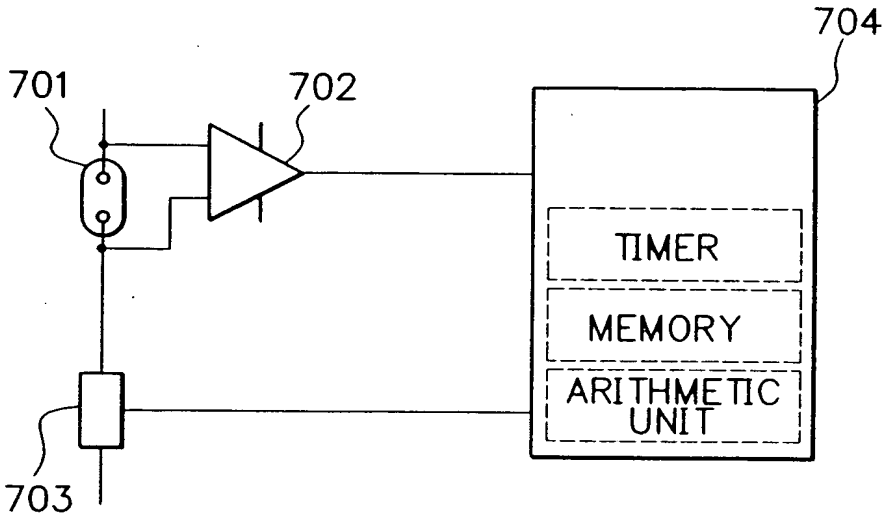

704
701
702
TIMER
MEMORY
ARITHMETIC UNIT
703

FIG. 8

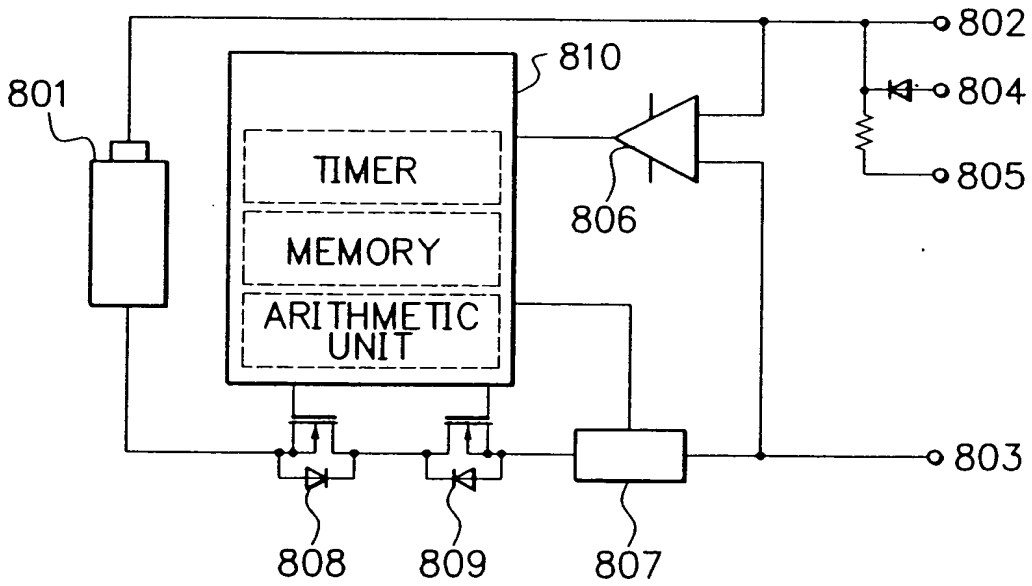

802
810
801
804
TIMER
805
MEMORY
806
ARITHMETIC UNIT
803
808
809
807

FIG. 9

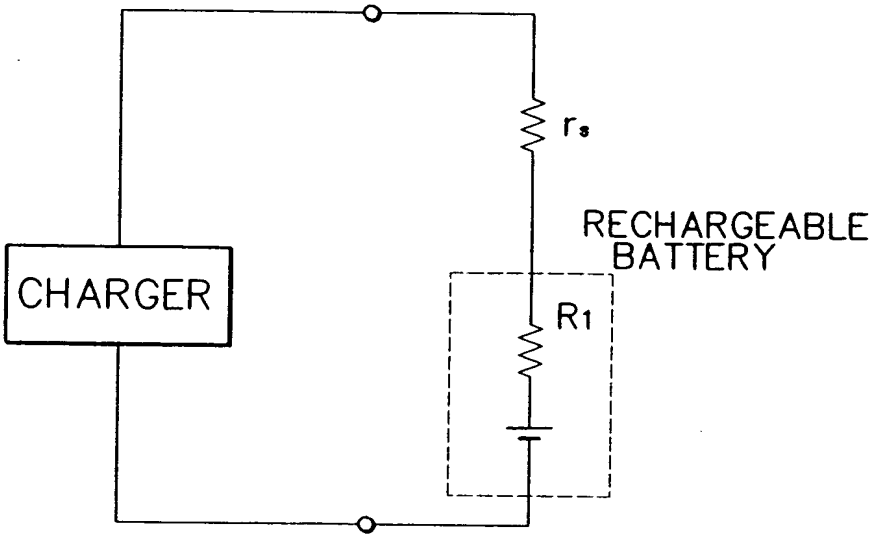

r_s
RECHARGEABLE BATTERY
CHARGER
R1

FIG. 10

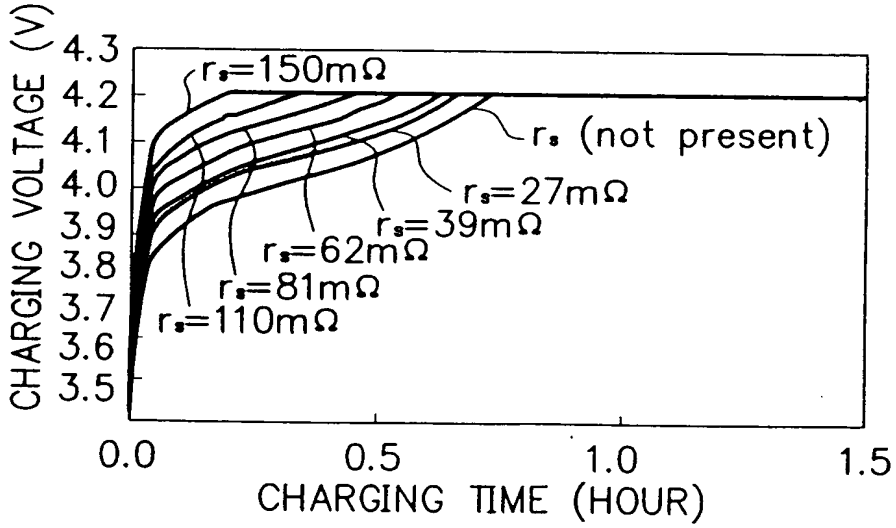

CHARGING VOLTAGE (V)
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
r_s=150mΩ
r_s (not present)
r_s=27mΩ
r_s=39mΩ
r_s=62mΩ
r_s=81mΩ
r_s=110mΩ
0.0
0.5
1.0
1.5
CHARGING TIME (HOUR)

FIG. 11

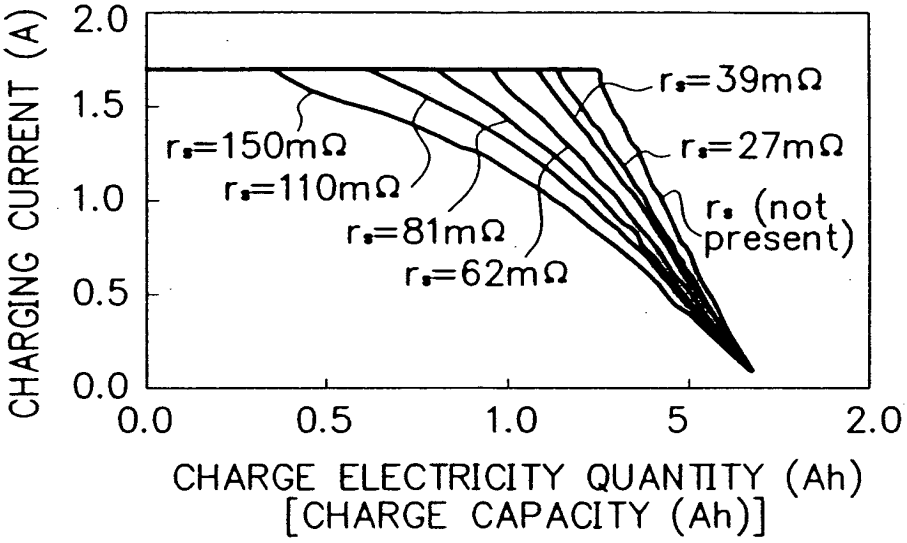

CHARGING CURRENT (A)
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
5
2.0
r_s=39mΩ
r_s=27mΩ
r_s (not present)
r_s=150mΩ
r_s=110mΩ
r_s=81mΩ
r_s=62mΩ
CHARGE ELECTRICITY QUANTITY (Ah)
[CHARGE CAPACITY (Ah)]

FIG. 12

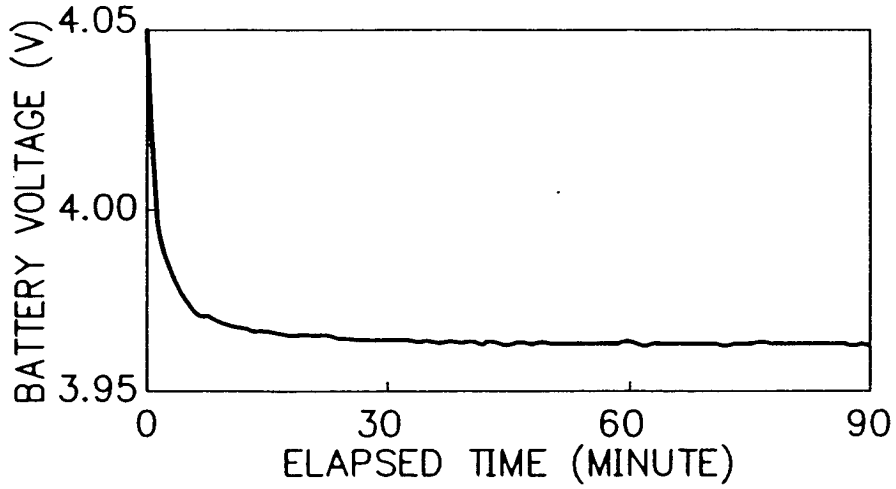

BATTERY VOLTAGE (V)
4.05
4.00
3.95
0
30
60
90
ELAPSED TIME (MINUTE)

FIG. 13

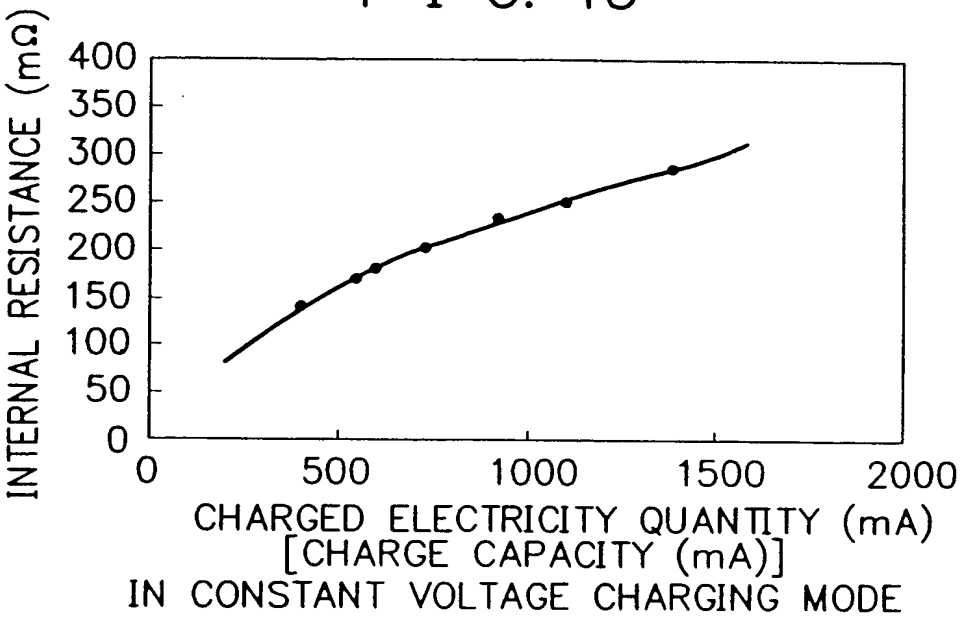

INTERNAL RESISTANCE (mΩ)
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
CHARGED ELECTRICITY QUANTITY (mA)
[CHARGE CAPACITY (mA)]
IN CONSTANT VOLTAGE CHARGING MODE

FIG. 14

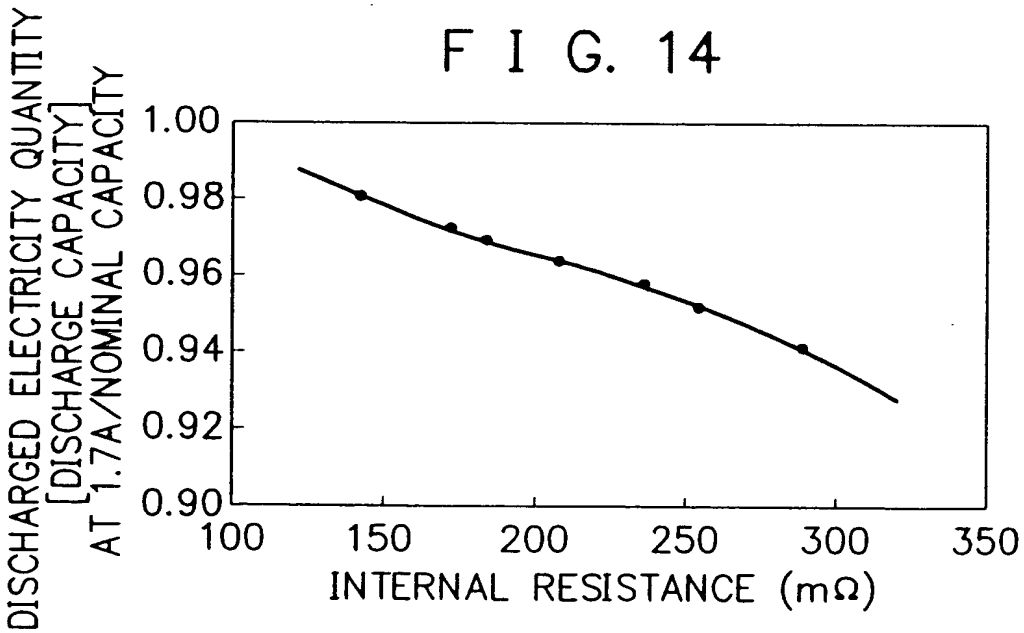

DISCHARGED ELECTRICITY QUANTITY
[DISCHARGE CAPACITY]
AT 1.7A/NOMINAL CAPACITY
1.00
0.98
0.96
0.94
0.92
0.90
100
150
200
250
300
350
INTERNAL RESISTANCE (mΩ)

FIG. 15

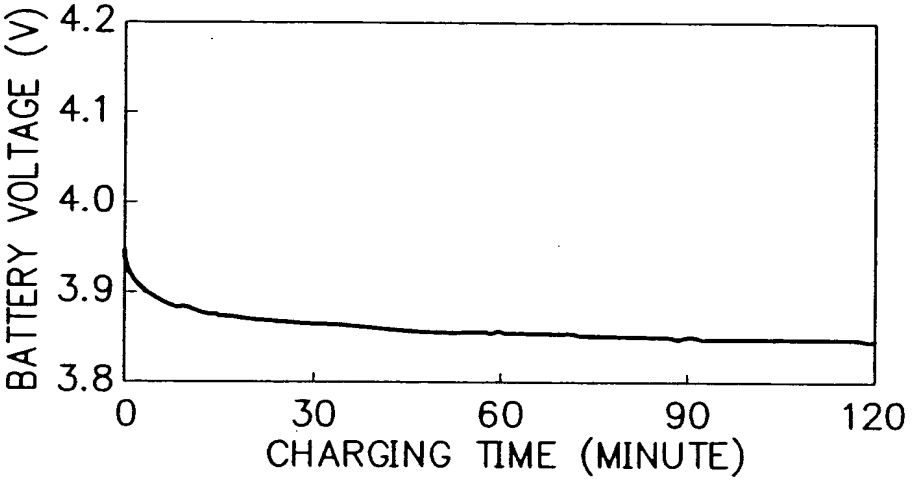
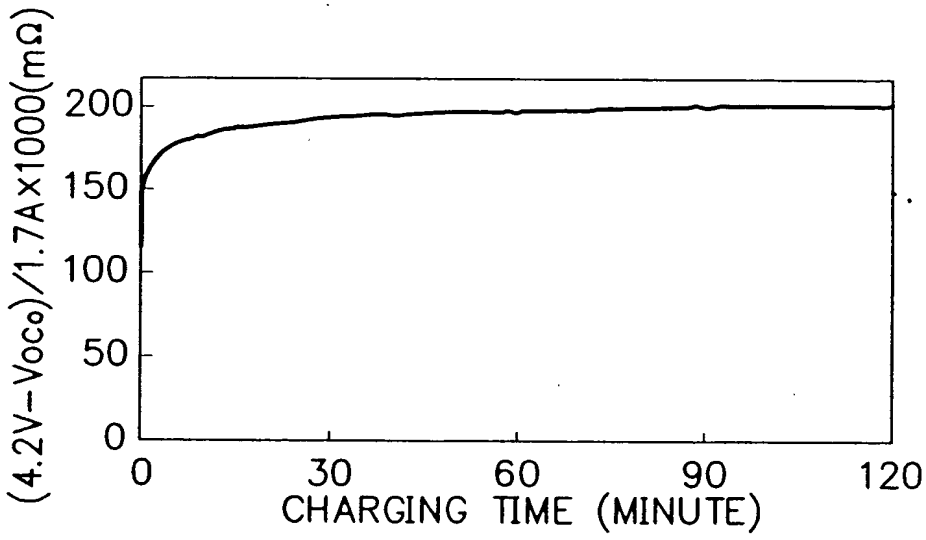
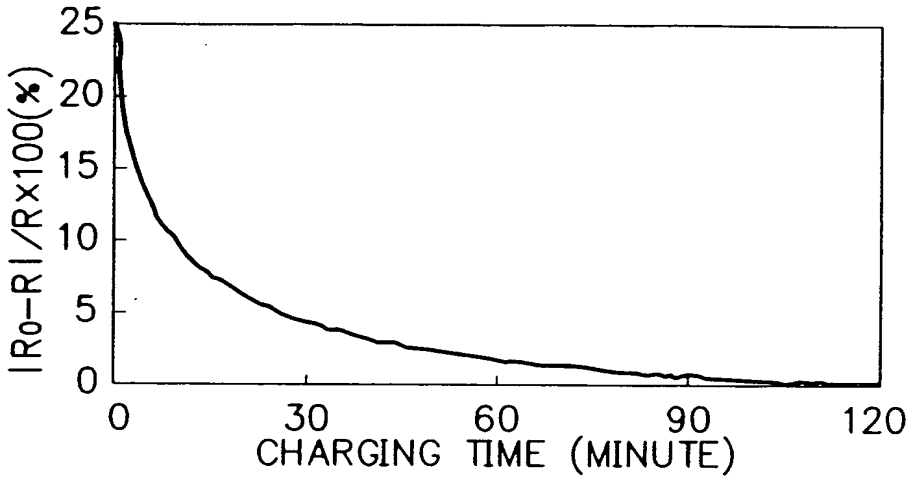

BATTERY VOLTAGE (V)
4.2
4.1
4.0
3.9
3.8
0
30
60
90
120
CHARGING TIME (MINUTE)

FIG. 16


(4.2V−Voco)/1.7A×1000(mΩ)
200
150
100
50
0
0
30
60
90
120
CHARGING TIME (MINUTE)

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